ArgoNeuT

Electronics Comparison 2

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ArgoNeuT

Goal & Method

- Study hit resolution and calorimetric response vs track angle
- For ArgoNeut and ICARUS electronics
  - Generate 100 muons that are…
    - Perpendicular to the collection plane wires, and
    - Have a dip angle of 0, 20°, 40° and 60° angle with respect to the collection plane
  - Reject events that contain δ rays of E > 5 MeV
  - Reconstruct hits with multiple hit mode OFF

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Shape Fitting

- Generate shapes for hit fitting for both electronics models
  - Use the shape fit parameters to determine the hit position
  - Use the hit pulse height sum to measure the ionization
    - Correct the pulse height sum for the path length - cos(dip)
    - Scale ArgoNeut pulse height sum to match ICARUS
      - ArgoNeut hits are wider than ICARUS hits
    - → PH Sum in following histograms

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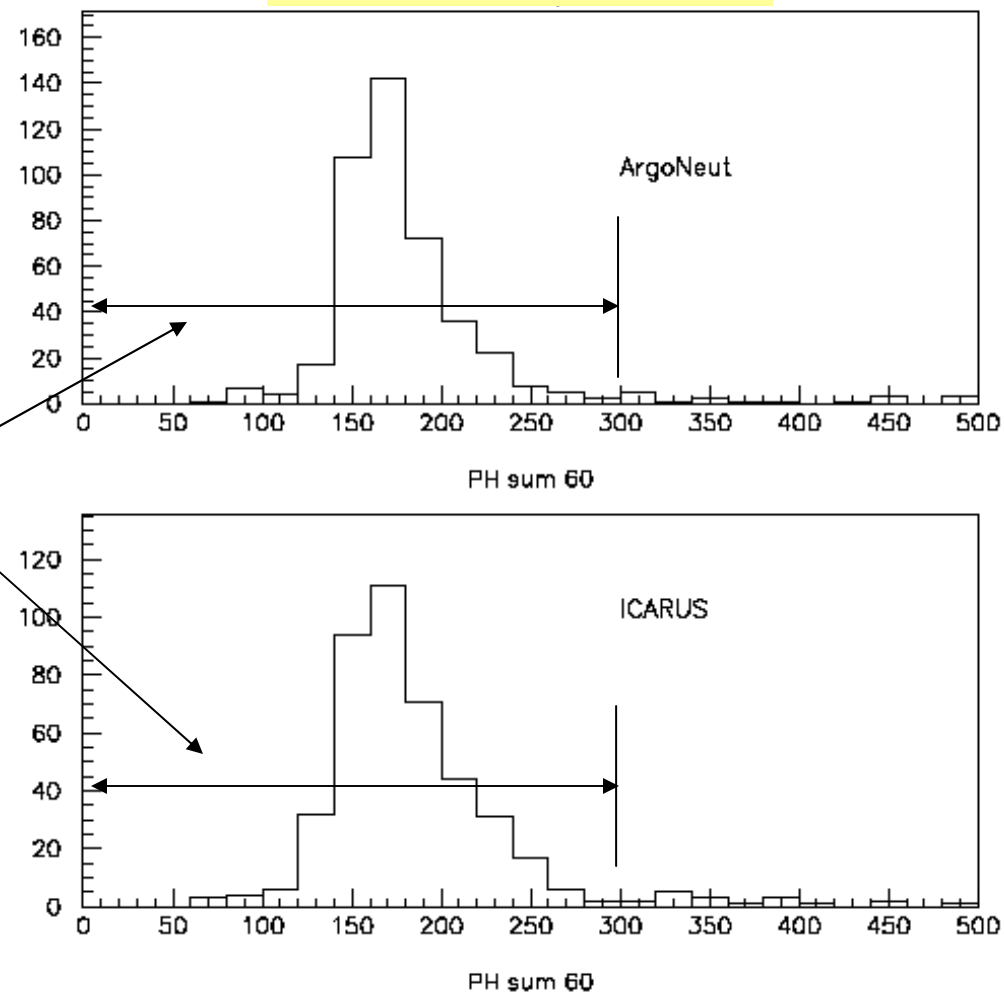
PH Sum Example

60° dip angle tracks

Range for Truncated PH Sum



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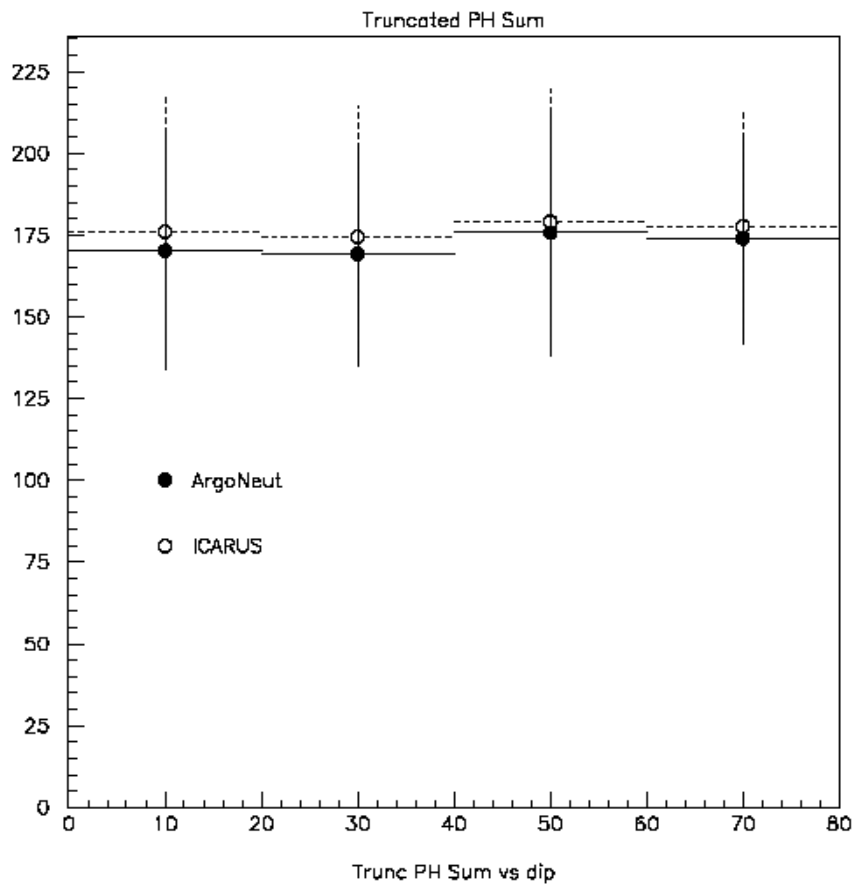
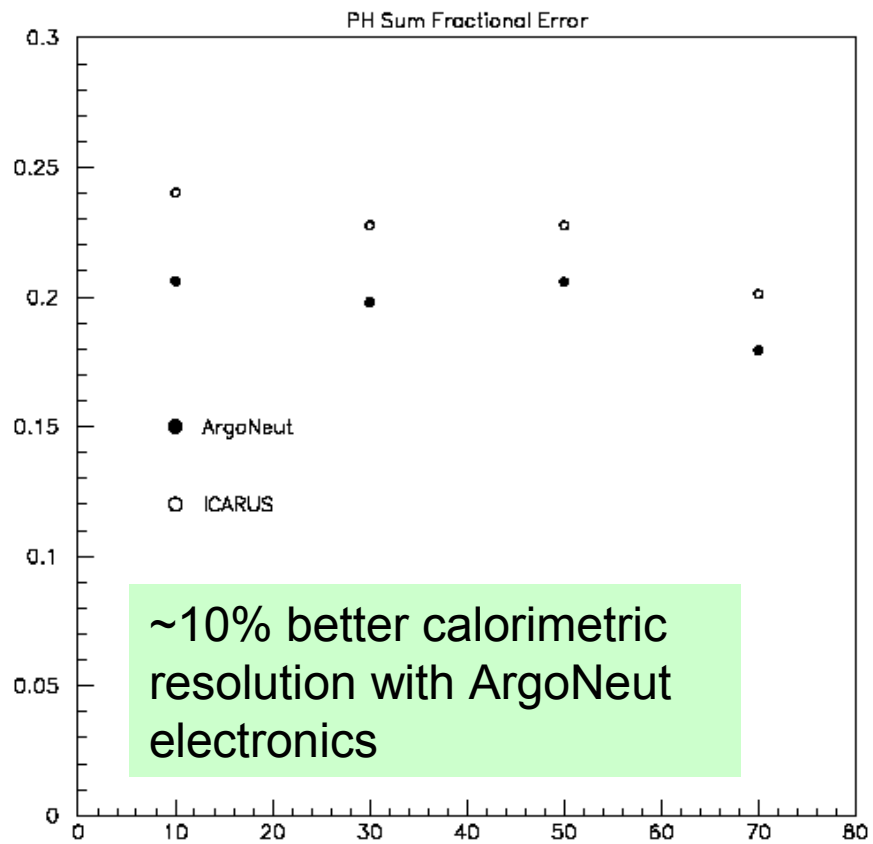
Truncated PH Sum vs Dip Angle





~10% better calorimetric resolution with ArgoNeut electronics

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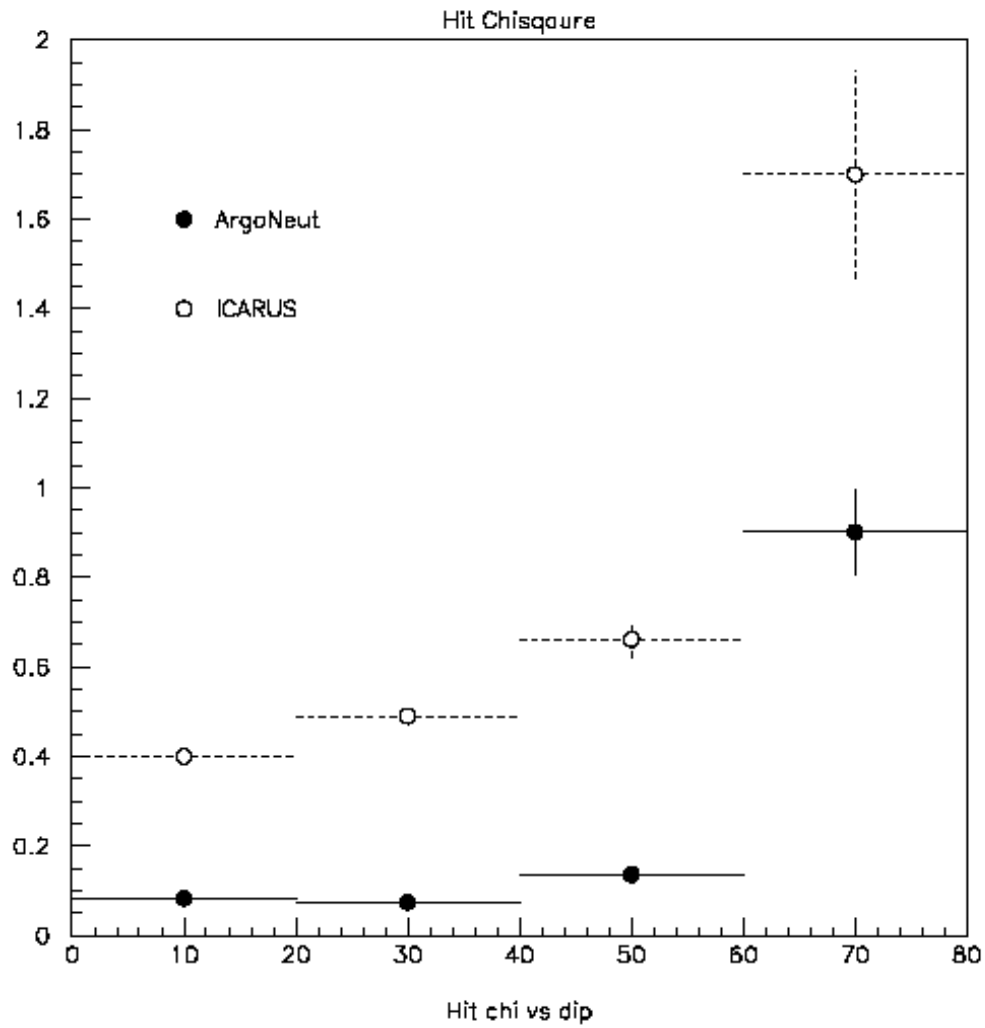
Hit Fit Chisq vs Dip

Hit resolution is dependent on the shape fit χ^2

The fit χ^2 is dependent on the quality of the library shapes

Hit fit shapes are probably not optimal



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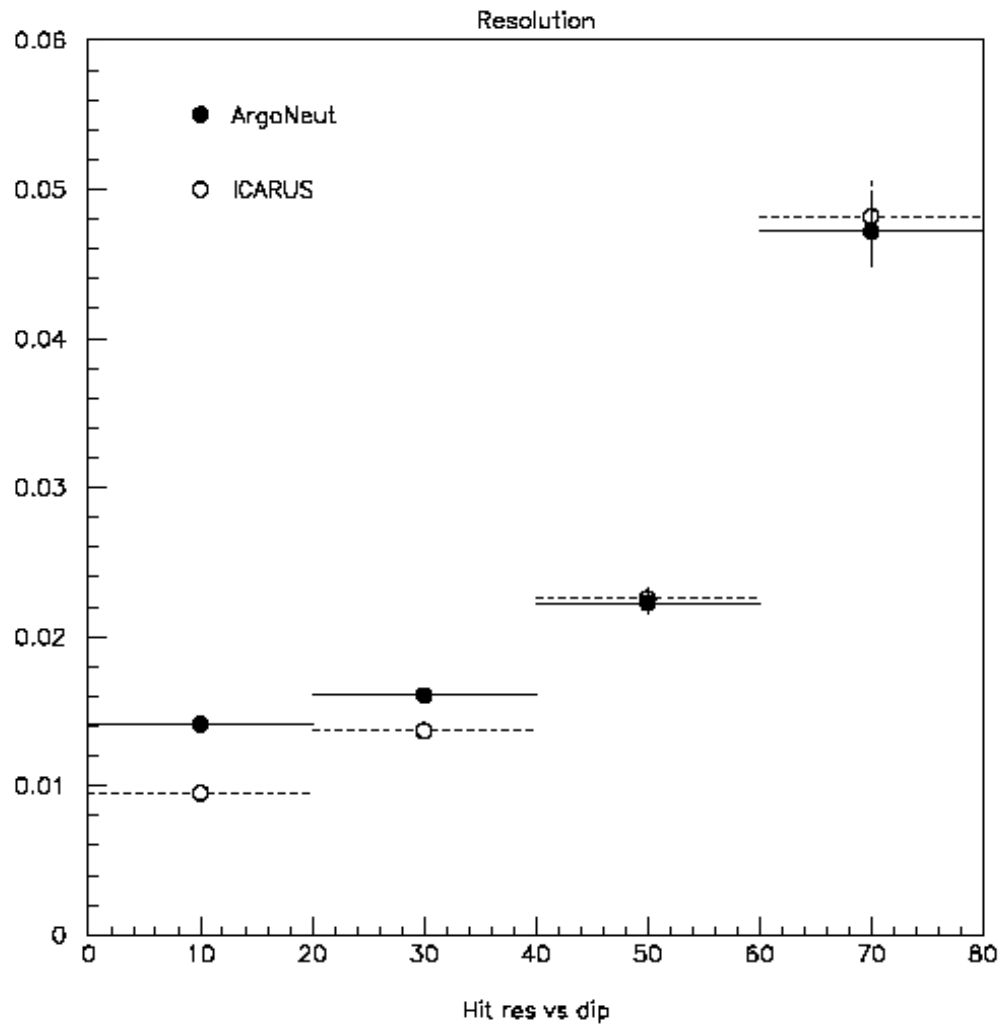
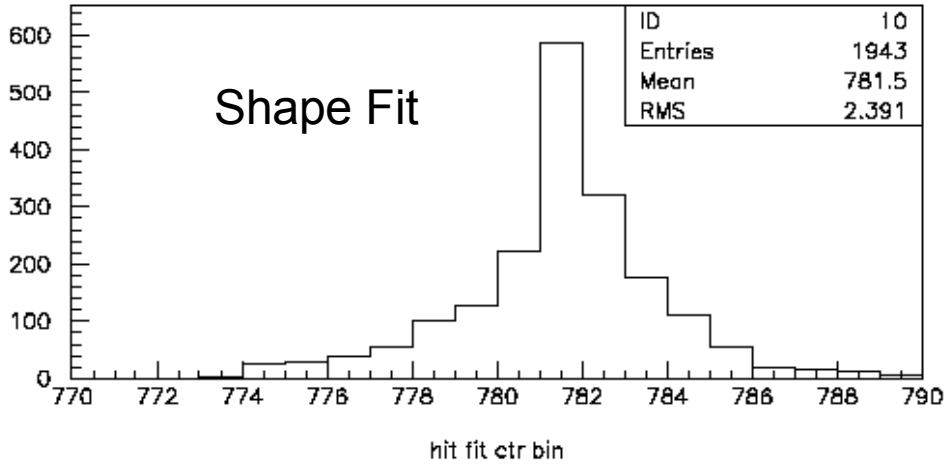
Hit Resolution vs Dip Angle

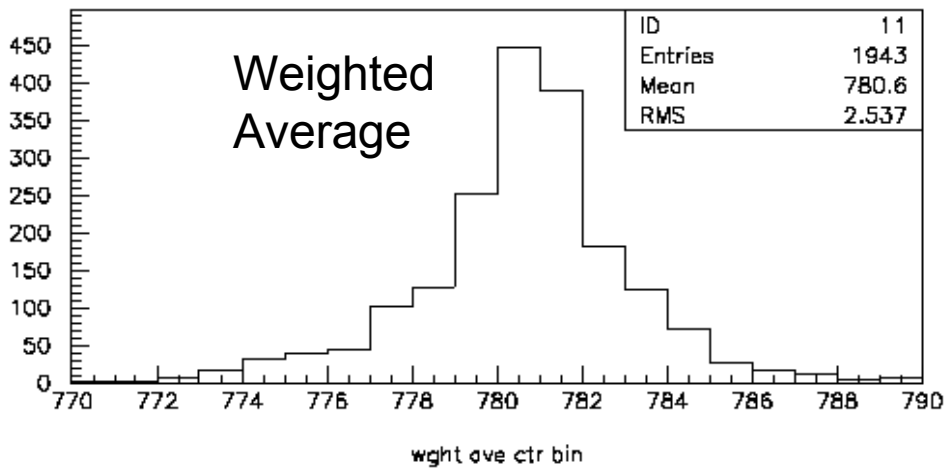


Shape Independent Resolution

- Histogram the charge weighted average time bin of each hit for 0° dip angle tracks
  - Ionization statistical fluctuations and multiple scattering fluctuations contribute to the width
- Compare with the time bin found by the shape fitting procedure

Shape Independent Resolution





Work in Progress

ArgoNeut Electronics

- Shape fit σ = 2.4 bins
- Wgt Ave σ = 2.5 bins

ICARUS Electronics

- Shape fit σ = 2.5 bins
- Wgt Ave σ = 2.7 bins

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Tentative Summary

- Correction from last talk
  - Electronics gain was 2x too high, noise ok
    - 1 MIP peak amplitude ~ 30 ADC counts
  - Better S/N w ArgoNeut electronics
    - ArgoNeut noise rms: 0.9 counts
    - ICARUS noise rms: 1.3 counts
- ArgoNeut calorimetric resolution ~ 10% better than ICARUS at all dip angles
- No significant difference in hit resolution
  - But hit shapes in the library may not be optimal